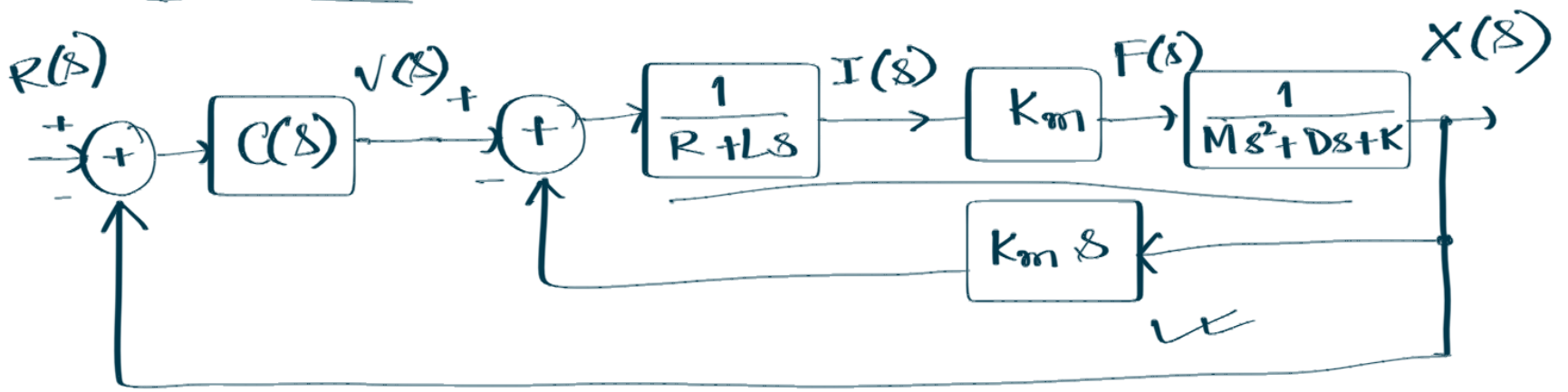


26 March:



Speaker tf: Choose  $R=1, L=1, K_m=1$   
 $M=1, D=3, K=2$

$$G(s) = \frac{1}{(s+1)^2 (s+2)}$$

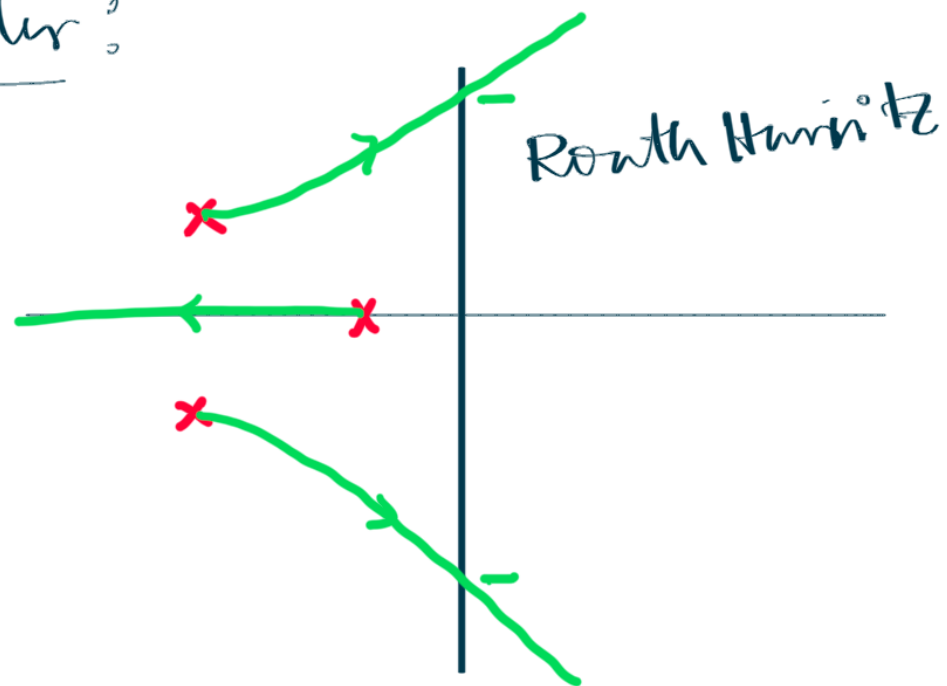
$$1 + \frac{s}{(s+1)^2 (s+2)}$$

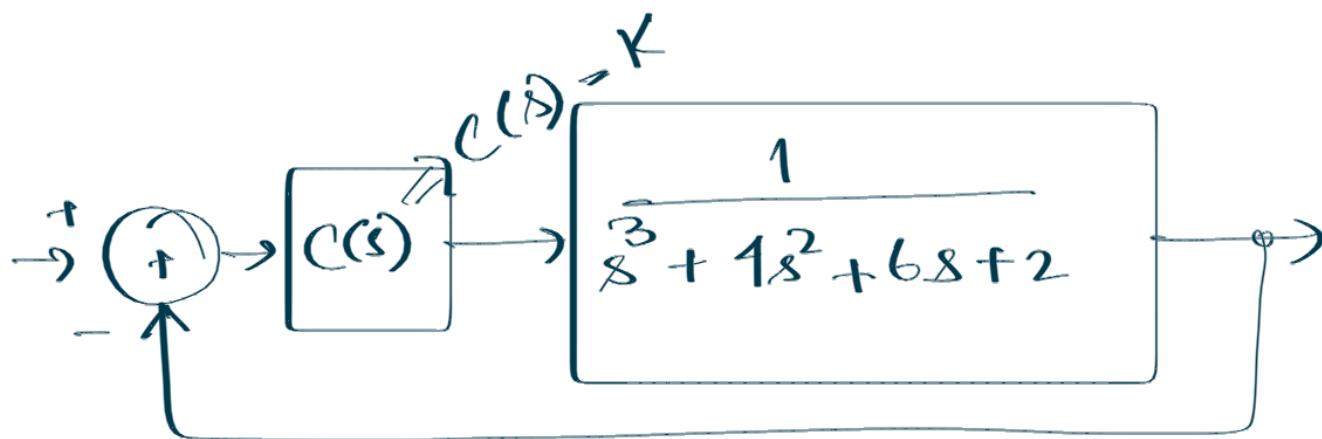
$$G(s) = \frac{1}{(s+1)^2 (s+2) + s}$$

$$= \frac{1}{(s^2 + 2s + 1)(s+2) + s}$$

$$= \frac{1}{s^3 + 4s^2 + 6s + 2}$$

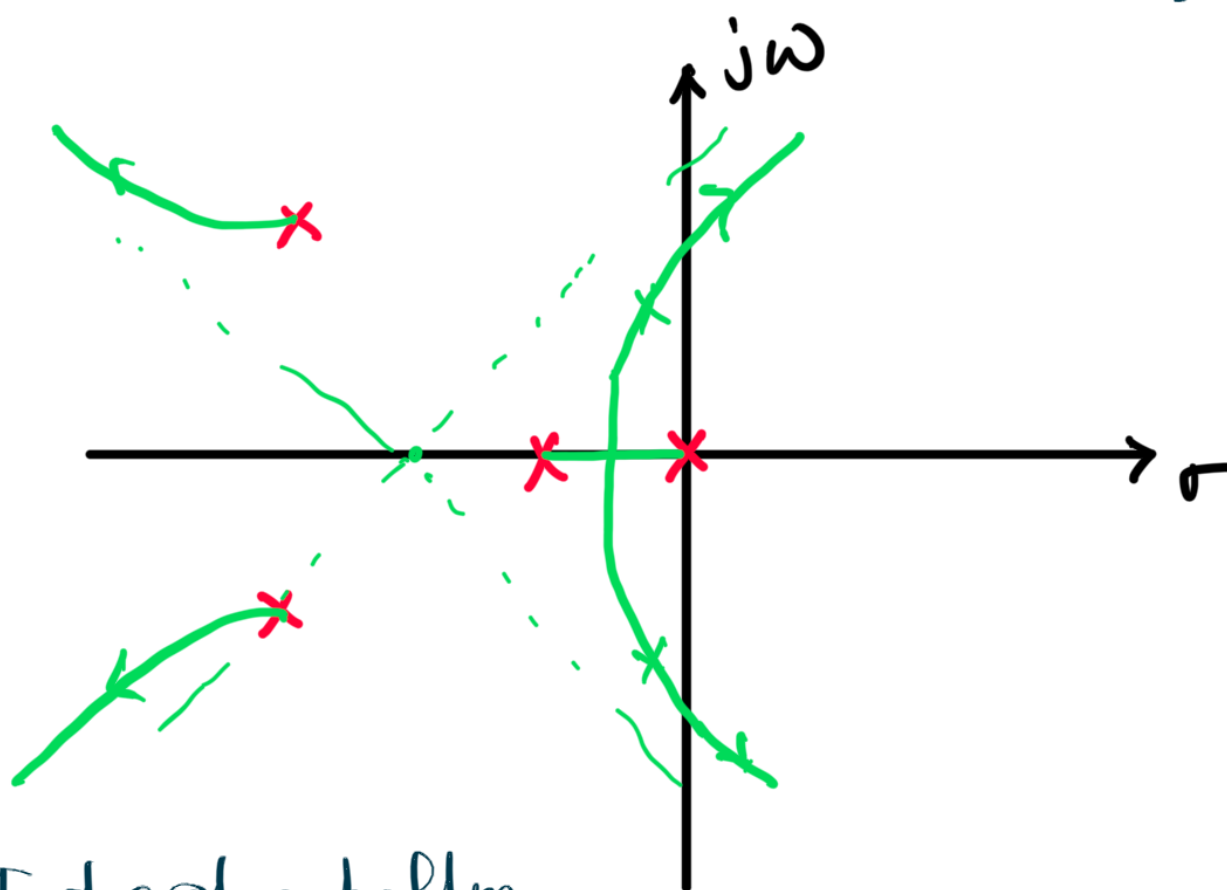
P controller:





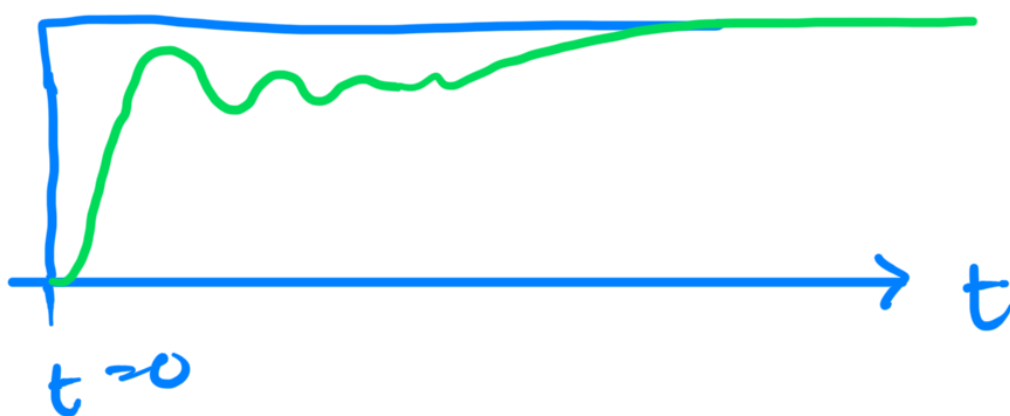
Position error constant  $K_p = \frac{K}{2}$

$$\Rightarrow e_{ss} = \frac{1}{1 + K_p} = \frac{1}{1 + \frac{K}{2}}$$



Integral controller

$$C(s) = \frac{K_I}{s}$$



Proportional + integral controller  
(PI controller)

$$C(s) = k_p + \frac{k_i}{s} = \frac{K(s+a)}{s}$$

